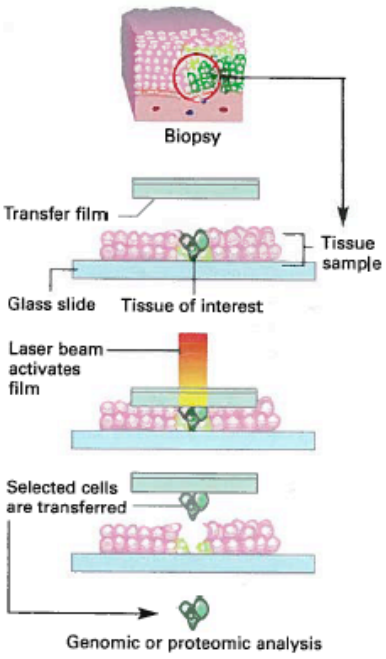
Exporting CCR Inventions

CCR scientists have created technologies to accelerate our capacity to prevent, detect, treat, and cure cancer

Laser-Capture Microdissection



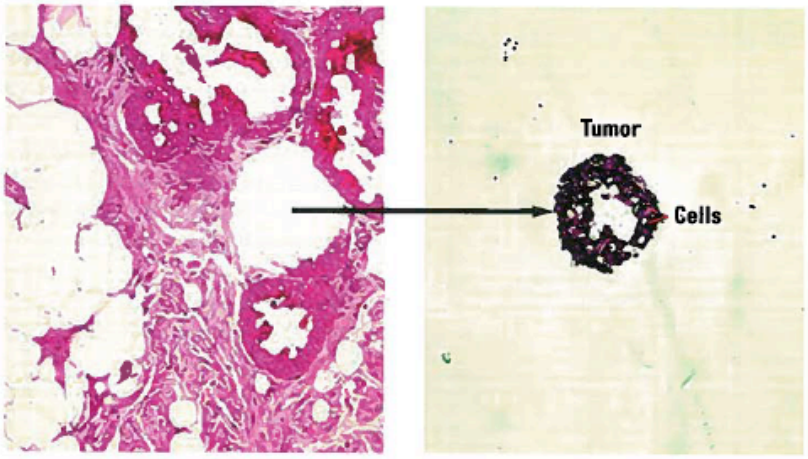
The technologies described on this page are used worldwide and are some examples of CCR's commitment to advancing cancer research through innovation and sharing of new technologies.

Innovations initiated at CCR in tumor pathology, molecular biology, and cytogenetics have contributed to oncology research in several ways. CCR rapidly deploys new technologies to the broader scientific community and provides training in these techniques. Often, CCR inventions are refined in collaboration with extramural engineers and biotechnology companies through licensing agreements. Three examples of inventions from the CCR are highlighted below.

Zeroing in on the Right Cells—Laser-Capture Microdissection

In 1996 Drs. Lance Liotta (now at George Mason University), Robert Bonner, and Michael Emmert-Buck invented laser-capture microdissection (LCM) to rapidly and precisely select specific cells from a biopsy sample. Diseased cells in a tissue sample are surrounded by a mixture of cell types, and isolating the target cells was a long-standing problem in pathology. However, LCM—using a low-energy laser beam and special transfer film—isolates normal, precancerous, and cancer cells for analysis and leaves behind unnecessary cellular information. Today, LCM is a well-established tool used throughout the world. The capacity to isolate molecules from a precise cell of origin has opened a floodgate of discoveries in genomics, functional genetics, and proteomics. In clinical trials, the technology is being applied to tissue biopsies obtained before, during, and after experimental therapy to determine the therapy's impact as early as possible. CCR makes state-of-the-art LCM instrumentation, technical support, and training available to NIH researchers and to researchers worldwide.

LCM selects a pure sample



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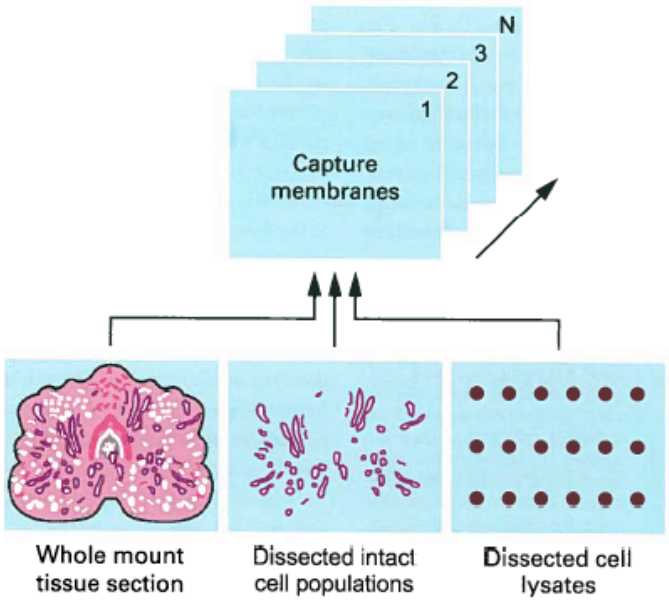
How to Profile Interacting Tissue Types—Layered Expression Scanning

Once they were able to segregate cell types with precision using LCM, CCR scientists wanted to be able to measure the molecular profile of each cell type in a tissue section, and they wanted a profile that preserved the two-dimensional relationship between interacting cells. Dr. Michael Emmert-Buck envisioned that such technology could enable an integrated genomics and proteomics analysis of tumor and normal tissue samples. Convinced that this technology would accelerate the identification of molecular targets, Dr. Emmert-Buck invented Layered Expression Scanning (LES) in 2000. This new technology uses a layered array of membranes coupled to antibodies, peptides, or DNA sequences that can capture targeted proteins, antibodies, or mRNAs as they cross the membranes.

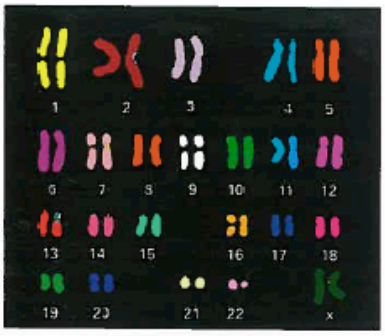
Adding a Rainbow of Detail to Chromosome Viewing—Spectral Karyotyping (SKY)

In 1996 Dr. Thomas Ried invented spectral karyotyping (SKY) and revolutionized the process of karyotyping. SKY translates computer-gathered light waves into a full-color palette and assigns each chromosome its own distinct hue. With all 23 pairs of human chromosomes identified by a different color, scientists can more easily examine the entire group of chromosomes for changes that could be associated with disease, such as missing or extra pieces of genetic material, or exchange of genetic material between chromosomes. Before this invention, karyotyping distinguished chromosomes using shades of gray--a much less effective approach. Dr. Ried has trained and collaborated with researchers in the United States and abroad to expand the use of this valuable method.

Layered Expresses Membranes



Spectral Karyotyping (SKY)



Karyotype of a normal cell.

SKY analysis of chromosomes prepared from a BRCA1-mutation associated breast carcinoma. Note that numerous chromosomes are involved in rearrangements, including chromosome breaks and chromosomal fusions. This pronounced genetic instability is a hallmark of BRCA1-associated cancers.

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